

AMENDMENTS TO THE CLAIMS

Claims 1-14 (Cancelled).

15. (New) An operation control method using a fuel injection device, comprising:

pressurizing fuel from a fuel tank using a high-pressure pump so that the pressurized fuel is stored in a common rail;

supplying the pressurized fuel stored in the common rail to an injection nozzle connected to the common rail; and

controlling the pressure of the pressurized fuel stored in the common rail by using a low-pressure control solenoid valve upstream of the high-pressure pump, and by using a high-pressure control solenoid valve downstream of the high-pressure pump, one of the low-pressure control solenoid valve and the high-pressure control solenoid valve being selectively feedback-controlled to control the pressure of the pressurized fuel stored in the common rail;

wherein said controlling includes, when an engine is in a predetermined start-up state, driving the high-pressure control solenoid valve until a predetermined period of time passes after the engine is activated, to thereby control a pressure in the common rail.

16. (New) The operation control method of claim 15, wherein said selective feedback-controlling of one of the low-pressure control solenoid valve and the high-pressure control solenoid valve comprises selectively driving one of the low-pressure control solenoid valve and the high-pressure control solenoid based at least in part on a detected pressure of the pressurized fuel in the common rail.

17. (New) An operation control method using a fuel injection device, comprising:

pressurizing fuel from a fuel tank using a high-pressure pump so that the pressurized fuel is stored in a common rail;

supplying the pressurized fuel stored in the common rail to an injection nozzle connected to the common rail; and

controlling the pressure of the pressurized fuel stored in the common rail by using a low-pressure control solenoid valve upstream of the high-pressure pump, and by using a high-pressure control solenoid valve downstream of the high-pressure pump, one of the low-pressure control solenoid valve and the high-pressure control solenoid valve being selectively feedback-controlled to control the pressure of the pressurized fuel stored in the common rail, wherein said selective feedback-controlling of one of the low-pressure control solenoid valve and the high-pressure control solenoid valve comprises one of:

determining whether an engine is in a start-up mode, and if the engine is in the start-up mode, controlling the common rail pressure by feedback-controlling the high-pressure control solenoid valve for a predetermined period of time;

determining whether an absolute value of a fluctuation in the common rail pressure per unit time exceeds a predetermined pressure fluctuation value, and if the absolute value of the fluctuation does exceed the predetermined pressure fluctuation value, controlling the common rail pressure by feedback-controlling the high-pressure control solenoid valve;

determining whether a fluctuation of the driving torque of the high-pressure pump is occurring, and if the fluctuation of the driving torque is occurring, controlling the common rail pressure by feedback-controlling the high-pressure control solenoid valve;

determining whether an average driving torque of the high-pressure pump exceeds a predetermined driving torque value, and if the average driving torque does exceed the predetermined driving torque value, controlling the common rail pressure by feedback-controlling the low-pressure control solenoid valve;

determining whether a temperature of the fuel is in a predetermined high temperature state or a predetermined low temperature state and whether the common rail pressure is being

controlled by the high-pressure control solenoid valve or the low-pressure control solenoid valve, and:

if the temperature of the fuel is in the predetermined high-temperature state and the common rail pressure is being controlled by the high-pressure control solenoid valve, controlling the common rail pressure by feedback-controlling the low-pressure control solenoid valve until the temperature of the fuel falls to within a predetermined reference temperature range; and

if the temperature of the fuel is in the predetermined low-temperature state and the common rail pressure is being controlled by the low-pressure control solenoid valve, controlling the common rail pressure by feedback-controlling the high-pressure control solenoid valve until the temperature of the fuel rises to within a predetermined reference temperature range; and

determining whether operation of the fuel injection device is in a predetermined unstable state, and when the operation is in the predetermined unstable state, controlling the common rail pressure by feedback-controlling the high-pressure control solenoid valve.

18. (New) The operation control method of claim 17, wherein said selective feedback-controlling of one of the low-pressure control solenoid valve and the high-pressure control solenoid valve comprises selectively driving one of the low-pressure control solenoid valve and the high-pressure control solenoid based at least in part on a detected pressure of the pressurized fuel in the common rail.

19. (New) An operation control method using a fuel injection device, comprising:

pressurizing fuel from a fuel tank using a high-pressure pump so that the pressurized fuel is stored in a common rail;

supplying the pressurized fuel stored in the common rail to an injection nozzle connected to the common rail; and

controlling the pressure of the pressurized fuel stored in the common rail by using a low-pressure control solenoid valve upstream of the high-pressure pump, and by using a high-pressure control solenoid valve downstream of the high-pressure pump, one of the low-pressure control solenoid valve and the high-pressure control solenoid valve being selectively feedback-controlled to control the pressure of the pressurized fuel stored in the common rail, wherein said selective feedback-controlling of one of the low-pressure control solenoid valve and the high-pressure control solenoid valve comprises repeatedly and sequentially performing a first procedure to a sixth procedure, including:

a first procedure including determining whether an engine is in a start-up mode, and if the engine is in the start-up mode, controlling the common rail pressure by feedback-controlling the high-pressure control solenoid valve for a predetermined period of time;

a second procedure including determining whether an absolute value of a fluctuation in the common rail pressure per unit time exceeds a predetermined pressure fluctuation value, and if the absolute value of the fluctuation does exceed the predetermined pressure fluctuation value, controlling the common rail pressure by feedback-controlling the high-pressure control solenoid valve;

a third procedure including determining whether a fluctuation of the driving torque of the high-pressure pump is occurring, and if the fluctuation of the driving torque is occurring, controlling the common rail pressure by feedback-controlling the high-pressure control solenoid valve;

a fourth procedure including determining whether an average driving torque of the high-pressure pump exceeds a predetermined driving torque value, and if the average driving torque does exceed the predetermined driving torque value, controlling the common rail pressure by feedback-controlling the low-pressure control solenoid valve;

a fifth procedure including determining whether a temperature of the fuel is in a predetermined high temperature state or a predetermined low temperature state and whether the

common rail pressure is being controlled by the high-pressure control solenoid valve or the low-pressure control solenoid valve, and:

if the temperature of the fuel is in the predetermined high-temperature state and the common rail pressure is being controlled by the high-pressure control solenoid valve, controlling the common rail pressure by feedback-controlling the low-pressure control solenoid valve until the temperature of the fuel falls to within a predetermined reference temperature range; and

if the temperature of the fuel is in the predetermined low-temperature state and the common rail pressure is being controlled by the low-pressure control solenoid valve, controlling the common rail pressure by feedback-controlling the high-pressure control solenoid valve until the temperature of the fuel rises to within a predetermined reference temperature range; and

a sixth procedure including determining whether operation of the fuel injection device is in a predetermined unstable state, and when the operation is in the predetermined unstable state, controlling the common rail pressure by feedback-controlling the high-pressure control solenoid valve.

20. (New) The operation control method of claim 19, wherein said selective feedback-controlling of one of the low-pressure control solenoid valve and the high-pressure control solenoid valve comprises selectively driving one of the low-pressure control solenoid valve and the high-pressure control solenoid based at least in part on a detected pressure of the pressurized fuel in the common rail.

21. (New) An operation control method using a fuel injection device, comprising:

pressurizing fuel from a fuel tank using a high-pressure pump so that the pressurized fuel is stored in a common rail;

supplying the pressurized fuel stored in the common rail to an injection nozzle connected to the common rail; and

controlling the pressure of the pressurized fuel stored in the common rail by using a low-pressure control solenoid valve upstream of the high-pressure pump, and by using a high-pressure control solenoid valve downstream of the high-pressure pump, one of the low-pressure control solenoid valve and the high-pressure control solenoid valve being selectively feedback-controlled to control the pressure of the pressurized fuel stored in the common rail, wherein said selective feedback-controlling of one of the low-pressure control solenoid valve and the high-pressure control solenoid valve comprises at least two procedures, including:

a first procedure including determining whether an engine is in a start-up mode, and if the engine is in the start-up mode, controlling the common rail pressure by feedback-controlling the high-pressure control solenoid valve for a predetermined period of time; and

a second procedure including determining whether a temperature of the fuel is in a predetermined high temperature state or a predetermined low temperature state and whether the common rail pressure is being controlled by the high-pressure control solenoid valve or the low-pressure control solenoid valve, and:

if the temperature of the fuel is in the predetermined high-temperature state and the common rail pressure is being controlled by the high-pressure control solenoid valve, controlling the common rail pressure by feedback-controlling the low-pressure control solenoid valve until the temperature of the fuel falls to within a predetermined reference temperature range; and

if the temperature of the fuel is in the predetermined low-temperature state and the common rail pressure is being controlled by the low-pressure control solenoid valve, controlling the common rail pressure by feedback-controlling the high-pressure control solenoid valve until the temperature of the fuel rises to within a predetermined reference temperature range.

22. (New) The operation control method of claim 21, wherein said selective feedback-controlling of one of the low-pressure control solenoid valve and the high-pressure control solenoid valve comprises selectively driving one of the low-pressure control solenoid valve and the high-pressure control solenoid based at least in part on a detected pressure of the pressurized fuel in the common rail.

23. (New) A fuel injection device comprising:

- a fuel tank for storing fuel;

- a common rail for storing pressurized fuel;

- a high-pressure pump connected to said fuel tank and said common rail, said high-pressure tank being operable to pressurize fuel from said fuel tank so that the pressurized fuel is stored in said common rail;

- an injection nozzle connected to said common rail so as to receive the pressurized fuel from said common rail;

- a low-pressure control solenoid valve upstream of said high-pressure pump;

- a high-pressure control solenoid valve downstream of said high-pressure pump; and

- a control unit for selectively feedback-controlling one of said low-pressure control solenoid valve and said high-pressure control solenoid valve to control the pressure of the pressurized fuel stored in said common rail, said control unit being operable to determine whether an engine is in a predetermined start-up state, and when the engine is in the predetermined start-up state, said control unit is further operable to drive said high-pressure control solenoid valve until a predetermined period of time passes after the engine is activated, to thereby control a pressure in said common rail, and when the engine is not in the predetermined start-up state, said control unit is further operable to drive said low-pressure control solenoid valve.

24. (New) The fuel injection device of claim 23, wherein said control unit is further operable to selectively drive one of said low-pressure control solenoid valve and said high-pressure control solenoid valve based on a temperature of the fuel, a pressure in said common rail, a rotation speed of the engine, an accelerator depression amount, and position information of an ignition engine key.

25. (New) The fuel injection device of claim 23, wherein said control unit is further operable to selectively drive one of said low-pressure control solenoid valve and said high-pressure control solenoid valve based at least in part on a detected pressure of the pressurized fuel in said common rail.

26. (New) A fuel injection device comprising:

- a fuel tank for storing fuel;

- a common rail for storing pressurized fuel;

- a high-pressure pump connected to said fuel tank and said common rail, said high-pressure tank being operable to pressurize fuel from said fuel tank so that the pressurized fuel is stored in said common rail;

- an injection nozzle connected to said common rail so as to receive the pressurized fuel from said common rail;

- a low-pressure control solenoid valve upstream of said high-pressure pump;

- a high-pressure control solenoid valve downstream of said high-pressure pump; and

- a control unit for selectively feedback-controlling one of said low-pressure control solenoid valve and said high-pressure control solenoid valve to control the pressure of the pressurized fuel stored in said common rail, said control unit being operable to selectively feedback-control one of said low-pressure control solenoid valve and said high-pressure control solenoid valve by performing any one of:

determining whether an engine is in a start-up mode, and if the engine is in the start-up mode, controlling said common rail pressure by feedback-controlling said high-pressure control solenoid valve for a predetermined period of time;

determining whether an absolute value of a fluctuation in the common rail pressure per unit time exceeds a predetermined pressure fluctuation value, and if the absolute value of the fluctuation does exceed the predetermined pressure fluctuation value, controlling the common rail pressure by feedback-controlling said high-pressure control solenoid valve;

determining whether a fluctuation of the driving torque of said high-pressure pump is occurring, and if the fluctuation of the driving torque is occurring, controlling the common rail pressure by feedback-controlling said high-pressure control solenoid valve;

determining whether an average driving torque of said high-pressure pump exceeds a predetermined driving torque value, and if the average driving torque does exceed the predetermined driving torque value, controlling the common rail pressure by feedback-controlling said low-pressure control solenoid valve;

determining whether a temperature of the fuel is in a predetermined high temperature state or a predetermined low temperature state and whether the common rail pressure is being controlled by said high-pressure control solenoid valve or said low-pressure control solenoid valve, and:

if the temperature of the fuel is in the predetermined high-temperature state and the common rail pressure is being controlled by said high-pressure control solenoid valve, controlling the common rail pressure by feedback-controlling said low-pressure control solenoid valve until the temperature of the pressurized fuel falls to within a predetermined reference temperature range; and

if the temperature of the pressurized fuel is in the predetermined low-temperature state and the common rail pressure is being controlled by said low-pressure control solenoid valve, controlling the common rail pressure by feedback-controlling said high-pressure

control solenoid valve until the temperature of the pressurized fuel rises to within a predetermined reference temperature range; and

determining whether operation of said fuel injection device is in a predetermined unstable state, and when the operation is in the predetermined unstable state, controlling the common rail pressure by feedback-controlling said high-pressure control solenoid valve.

27. (New) The fuel injection device of claim 26, wherein said control unit is further operable to selectively drive one of said low-pressure control solenoid valve and said high-pressure control solenoid valve based on a temperature of the fuel, a pressure in said common rail, a rotation speed of the engine, an accelerator depression amount, and position information of an ignition engine key.

28. (New) The fuel injection device of claim 26, wherein said control unit is further operable to selectively drive one of said low-pressure control solenoid valve and said high-pressure control solenoid valve based at least in part on a detected pressure of the pressurized fuel in said common rail.

29. (New) A fuel injection device comprising:

a fuel tank for storing fuel;

a common rail for storing pressurized fuel;

a high-pressure pump connected to said fuel tank and said common rail, said high-pressure tank being operable to pressurize fuel from said fuel tank so that the pressurized fuel is stored in said common rail;

an injection nozzle connected to said common rail so as to receive the pressurized fuel from said common rail;

a low-pressure control solenoid valve upstream of said high-pressure pump;

a high-pressure control solenoid valve downstream of said high-pressure pump; and

a control unit for selectively feedback-controlling one of said low-pressure control solenoid valve and said high-pressure control solenoid valve to control the pressure of the pressurized fuel stored in said common rail, said control unit being operable to selectively feedback-control one of said low-pressure control solenoid valve and said high-pressure control solenoid valve by repeatedly and sequentially performing a first procedure to a sixth procedure, including:

a first procedure including determining whether an engine is in a start-up mode, and if the engine is in the start-up mode, controlling said common rail pressure by feedback-controlling said high-pressure control solenoid valve for a predetermined period of time;

a second procedure including determining whether an absolute value of a fluctuation in the common rail pressure per unit time exceeds a predetermined pressure fluctuation value, and if the absolute value of the fluctuation does exceed the predetermined pressure fluctuation value, controlling the common rail pressure by feedback-controlling said high-pressure control solenoid valve;

a third procedure including determining whether a fluctuation of the driving torque of said high-pressure pump is occurring, and if the fluctuation of the driving torque is occurring, controlling the common rail pressure by feedback-controlling said high-pressure control solenoid valve;

a fourth procedure including determining whether an average driving torque of said high-pressure pump exceeds a predetermined driving torque value, and if the average driving torque does exceed the predetermined driving torque value, controlling the common rail pressure by feedback-controlling said low-pressure control solenoid valve;

a fifth procedure including determining whether a temperature of the fuel is in a predetermined high temperature state or a predetermined low temperature state and whether the common rail pressure is being controlled by said high-pressure control solenoid valve or said low-pressure control solenoid valve, and:

if the temperature of the fuel is in the predetermined high-temperature state and the common rail pressure is being controlled by said high-pressure control solenoid valve, controlling the common rail pressure by feedback-controlling said low-pressure control solenoid valve until the temperature of the pressurized fuel falls to within a predetermined reference temperature range; and

if the temperature of the pressurized fuel is in the predetermined low-temperature state and the common rail pressure is being controlled by said low-pressure control solenoid valve, controlling the common rail pressure by feedback-controlling said high-pressure control solenoid valve until the temperature of the pressurized fuel rises to within a predetermined reference temperature range; and

a sixth procedure including determining whether operation of said fuel injection device is in a predetermined unstable state, and when the operation is in the predetermined unstable state, controlling the common rail pressure by feedback-controlling said high-pressure control solenoid valve.

30. (New) The fuel injection device of claim 26, wherein said control unit is further operable to selectively drive one of said low-pressure control solenoid valve and said high-pressure control solenoid valve based on a temperature of the fuel, a pressure in said common rail, a rotation speed of the engine, an accelerator depression amount, and position information of an ignition engine key.

31. (New) The fuel injection device of claim 26, wherein said control unit is further operable to selectively drive one of said low-pressure control solenoid valve and said high-pressure control solenoid valve based at least in part on a detected pressure of the pressurized fuel in said common rail.

32. (New) A fuel injection device comprising:

a fuel tank for storing fuel;

a common rail for storing pressurized fuel;

a high-pressure pump connected to said fuel tank and said common rail, said high-pressure tank being operable to pressurize fuel from said fuel tank so that the pressurized fuel is stored in said common rail;

an injection nozzle connected to said common rail so as to receive the pressurized fuel from said common rail;

a low-pressure control solenoid valve upstream of said high-pressure pump;

a high-pressure control solenoid valve downstream of said high-pressure pump; and

a control unit for selectively feedback-controlling one of said low-pressure control solenoid valve and said high-pressure control solenoid valve to control the pressure of the pressurized fuel stored in said common rail, said control unit being operable to selectively feedback-control one of said low-pressure control solenoid valve and said high-pressure control solenoid valve by repeatedly and sequentially performing at least two procedures, including:

a first procedure including determining whether an engine is in a start-up mode, and if the engine is in the start-up mode, controlling said common rail pressure by feedback-controlling said high-pressure control solenoid valve for a predetermined period of time; and

a second procedure including determining whether a temperature of the fuel is in a predetermined high temperature state or a predetermined low temperature state and whether the common rail pressure is being controlled by said high-pressure control solenoid valve or said low-pressure control solenoid valve, and:

if the temperature of the fuel is in the predetermined high-temperature state and the common rail pressure is being controlled by said high-pressure control solenoid valve, controlling the common rail pressure by feedback-controlling said low-pressure control solenoid

valve until the temperature of the pressurized fuel falls to within a predetermined reference temperature range; and

if the temperature of the pressurized fuel is in the predetermined low-temperature state and the common rail pressure is being controlled by said low-pressure control solenoid valve, controlling the common rail pressure by feedback-controlling said high-pressure control solenoid valve until the temperature of the pressurized fuel rises to within a predetermined reference temperature range.

33. (New) The fuel injection device of claim 32, wherein said control unit is further operable to selectively drive one of said low-pressure control solenoid valve and said high-pressure control solenoid valve based on a temperature of the fuel, a pressure in said common rail, a rotation speed of the engine, an accelerator depression amount, and position information of an ignition engine key.

34. (New) The fuel injection device of claim 32, wherein said control unit is further operable to selectively drive one of said low-pressure control solenoid valve and said high-pressure control solenoid valve based at least in part on a detected pressure of the pressurized fuel in said common rail.